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University Technology Transfer

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Abstract

This article describes the experiences and general observations of the author at Heriot-Watt University and concerns the transfer of university technology for the purposes of commercialisation. Full commercial exploitation of a university invention generally requires transferring that technology into the industrial arena, usually either by formation of a new company or licensing into an existing company. Commercialisation activities need to be carried out in unison with the prime activities of the university of research and teaching. Responsibility for commercialising university inventions generally rests with a specific group within the university, typically referred to as the technology transfer group. Each technology transfer should be considered individually and appropriate arrangements made for that particular invention. In general, this transfer process involves four stages: identification, evaluation, protection and exploitation. Considerations under these general headings are outlined from a university viewpoint. A phased approach is generally preferred where possible for the evaluation, protection and exploitation of an invention to balance risk with potential reward. Evaluation of the potential opportunity for a university invention involves essentially the same considerations as for an industrial invention. However, there are a range of commercial exploitation routes and potential deals so that only general guidelines can be given. Naturally, the final deal achieved is that which can be negotiated. The potential rewards for the university and inventor are both financial (via licensing income and equity realisation) and non-financial.

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1. Introduction

This article describes the experiences and general observations of the author at Heriot-Watt University and concerns the transfer of university technology for the purposes of commercialisation.

Technology transfer, or commercial exploitation, of university inventions involves movement of those inventions from academia into the industrial environment, usually by formation of a new company or licensing into an existing company. Drivers for the universities include the desire to foster development of the technology to its full potential, utilise inventions to benefit the public and participate in local economic development. The transfer of technologies discovered in universities into industry for commercial exploitation can benefit the universities, industry, the local and UK economy and the public (as potential end users). Universities can benefit from the reward, retention and motivation of inventors, income generation, closer contact with industry, and gaining prestige and thereby attracting students. Industry in general can benefit by the creation of new companies based on innovations or by accessing leading edge technology without the need to maintain research groups in those areas. Transferring the invention from the university into industry enables the development, marketing and manufacturing skills of the latter to optimise the chance of successful commercial exploitation. Closer interaction of these two groups should also help each understand the needs and limitations of the other, facilitating even closer collaboration in the future. Universities have the prime roles of teaching and research, an important part of which is the dissemination of research results to promote further work. Industry has a prime requirement of generating income and competing effectively in the market place. Growth of new businesses and consequent sales generates wealth, benefiting the economy. The formation of spin-out companies locally can also benefit the local economy by retaining and attracting skilled, entrepreneurial individuals and potentially generating future profits and jobs.

For the university, the transfer of technology typically involves four steps: identification, evaluation, protection, and exploitation. Naturally, these four stages need to be carried out in unison with the teaching and research activities. Commercial exploitation and research can certainly be carried out in parallel, and there are optimal practices to facilitate success in technology transfer.

2. Identification

Obviously the first stage in technology transfer is for the opportunity to be identified. Since responsibility for commercialising university inventions generally rests with a specific group within the university, typically referred to as the technology transfer group, this generally involves that team becoming aware of the invention. Technology transfer groups tend to operate in reactive mode, with the researchers informing the group when they have an invention that may have commercial potential. However, in addition it is also useful to periodically undertake an audit of the ongoing research in the university to increase the chances of identifying commercialisable opportunities. Both approaches require the technology transfer group to maintain a high profile in the university to encourage notification of inventions , and importantly at a sufficiently early stage to enable protection and effective exploitation. Researchers

who have an existing working relationship with the technology transfer team often bring further inventions to the group.

A natural starting point is to discuss the invention with the inventor(s) to fully understand the potential benefits of the technology and explain the process involved in commercialising the innovation.

Once the technology transfer group is aware that an invention exists it is necessary to gather sufficient information to evaluate the invention to decide if, and how, to proceed. The simplest method is for the inventor(s) to complete an invention disclosure form. This form will typically supply information on the invention itself, ownership of intellectual property, disclosures, publications, patent applications and initial market research.

3. Evaluation

A phased approach to evaluation and progression is appropriate for university inventions in order to balance risk with potential reward. At Heriot-Watt University the information to base a decision on is gathered in an innovation disclosure form completed by the inventor(s). The technology transfer team undertakes initial desk-top market research and a prior art search. The former is used (together with information from the inventor) to indicate if there is a potential market for the invention and obtain a rough estimate of the order of magnitude of that opportunity. The latter is to check that the invention has not already been patented and that there would be freedom to operate in exploiting the invention without infringing existing patents. Obviously, patents still in the application stage and yet to be published may exist even if the prior art search finds no relevant patents. At Heriot-Watt University if the technology transfer group concludes that the invention has commercial potential, it will complete a business case with the inventor(s) which is then presented to a review board (the Innovation Exploitation Board) for approval of use of university resources. This review board consists of senior university representatives plus external people with appropriate business experience and expertise. If the technology transfer team concludes that the invention does not have sufficient commercial potential then this will be explained to the inventor(s), who will be encouraged to publish the results in the usual manner.

In general, evaluation of an invention involves consideration of criteria such as whether the invention can be clearly defined, if a unique selling proposition can be written (ideally in a single sentence), whether the competitive advantage is sustainable, if the invention can be protected, the ownership of the invention, whether the invention has potential commercial value, how the invention could be commercially exploited, the upfront resources required to commercialise the invention, and what the inventors want to do. Although there are a broader set of reasons for commercialising university inventions, the decision to use university resources to commercially exploit an innovation should generally be based on business considerations.

3.1 Can the Invention be Clearly Defined?

For commercial exploitation it is generally essential that the invention can be described to a non-expert in sufficient detail to understand the benefits it offers. Ultimately a sales force will have to sell the product or service based on the invention

in terms that a customer can understand. The benefits to a customer or end user are not the same as the features of the invention and require careful consideration.

3.2 Can a Unique Selling Proposition be Written, ideally in a Single Sentence?

In order to capture a business opportunity the invention must satisfy an unmet need. In general, a university invention needs to offer a unique product or service and to be able to sustain that advantage. Novel methods or products that merely provide the same benefits to the customer as alternative approaches although suitable for scientific publications are generally not commercially exploitable opportunities. Ideally, any current products or solutions should have serious problems necessitating their replacement.

For each invention the technology transfer team at Heriot-Watt University and the inventor(s) produce a single sentence unique selling proposition (USP) which highlights the unique aspects of the innovation. Where possible these unique aspects are quantified.

If a robust USP cannot be written then serious consideration should be given to not proceeding with commercial exploitation.

3.3 How Sustainable is the Competitive Advantage?

Consideration should also be given to how sustainable the unique advantages or benefits are compared with competitive approaches. A successful product or service will inevitably attract competition, and the response of competitors already in the area is rarely to do nothing and give up market share. Competition can come in the form of direct (in-kind) and not-in-kind competition. For example, in-kind competition for a new biodegradable plastic would be another biodegradable plastic with different properties in use, whereas not-in-kind competition would be the increased use of recycling waste to reduce the need for biodegradable plastics (disposed of by composting). Analysis of direct or in-kind competition is obviously easier to undertake than for not-in-kind or new technology competition. Protection of the intellectual property by patenting will exclude some of the direct competition but an entirely different approach to satisfy the unmet need will probably not be inhibited.

Access to a pipeline of future inventions from the laboratory/group that produced this innovation would be expected to increase the sustainability of the competitive advantage by maintaining the technology at the leading edge and potentially providing a range of products.

Speed to market and the first to enter into a new market can help to establish a particular product or service and build up customer loyalty, but this may be difficult to sustain in the long term. However, such considerations may influence the proposed business plan (e.g. in the use of an established marketing, sales and distribution route to minimise time to enter the market).

Sustainability of the competitive advantage is clearly of particular concern to a new company being formed to commercialise the opportunity.

3.4 Can the Invention be Protected?

Intellectual property (IP) can be protected by patent, know-how/trade secret, copyright or design right[1], with patenting and know-how typically utilised.

A significant problem for commercialisation in universities, with the requirement to publish research results, is disclosure of the invention prior to patenting. Once the invention has been disclosed into the public domain it cannot be comprehensively patented. Notable exceptions exist (e.g. for US patents) but in general it is problematic to rely on these. Disclosures include abstracts, papers, presentations, theses, etc which are made available publicly. Judgement as to what constitutes a disclosure can require expert input, so it is usually safest to have no publications or presentations prior to patenting. The innovation disclosure form used by Heriot-Watt University specifically asks about any and all disclosures. The presence of a disclosure which precludes comprehensive patenting is generally a reason not to attempt commercialisation of the invention if that is the required intellectual property protection route.

The problems of disclosure are also relevant for know-how, since the information will inevitably be of use to competitors.

Therefore part of the evaluation process is to establish not only if intellectual property protection is possible but also to decide how this will be done. If it is concluded that the intellectual property cannot be adequately protected then the invention should generally not be taken forward for commercial exploitation.

3.5 Who Owns the Invention?

Ownership of the invention is a critical selection criterion and clear ownership must be established upfront before proceeding with commercialisation. Ideally, the university should completely own an invention in order to commercialise it. This is generally the case if all the inventors are university employees and the invention was made in the course of their employment. However, student inventors may own intellectual property rights. Therefore it is important to establish clear ownership even if the invention was carried out solely within one university. Students can be asked to assign their intellectual property rights to the university in return for a share of resultant income (possibly a percentage of royalty income).

If the work was funded by an external organisation then they may own the intellectual property rights, depending on the signed agreement entered into. If an external inventor is involved then the intellectual property may be shared. One option then is for the external inventors to assign his or her rights to the university for a share of the future rewards. If IP is shared a clear exploitation plan needs to have been agreed with the other owner(s), with written agreements in place.

It is also important to establish that the university has freedom to operate in this area and that existing third party patents will not be infringed. This is addressed by the prior art search undertaken.

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[1] http://www.practicallaw.com/A38081

3.6 Does the Invention have Potential Commercial Value?

At the early stage of an invention it is usually difficult to obtain an estimate of potential commercial value. However some estimate of the value of that particular opportunity is required for the business case. An order of magnitude estimate of value may be sufficient at this stage. Estimates of overall market value and size are usually of limited use.

Potential sources of information to base an estimate of opportunity value on are market knowledge of inventor(s), information from industrial contacts of the inventor(s), market research reports and internet searches. General trends to also look for are whether this a growing or shrinking market, if the potential market is local or global, whether there is an opportunity to value price (i.e. charge what the product or service is truly worth) or if there is significant pressure on prices in this market and whether an anticipated competitive response to the entry into the market of this new product or service would be to lower prices.

Provided the invention is considered to have reasonable commercial value, the precise estimated amount is not necessarily a pass or fail criterion. Rather, the estimated value of the invention will influence the justifiable upfront cost that can be incurred to investigate and pursue the opportunity.

3.7 How could the Invention be Commercially Exploited?

Typical commercialisation routes for university inventions are consultancy, licensing, joint venture or spin-out company. The most appropriate commercialisation route should be agreed with the inventor(s). An agreed route to commercial exploitation is generally required before the invention is taken forward for commercialisation.

3.8 What Upfront Resources are Required to Commercialise the Invention?

Exploration and progression of commercialisation of an invention should be undertaken wherever possible in phases, so that the cost of investigating the next phase is minimised, with the ability to terminate activity at any phase. This approach is appropriate since in the early stages the commercial opportunity is generally somewhat unclear and the risk of an unsuccessful outcome is high. The justifiable upfront costs expended in investigating a commercial opportunity depend on the estimated size of the opportunity.

If the selected route to market is licensing and patent protection of intellectual property, then the upfront costs are essentially patenting costs and the time of the inventors and technology transfer team. This staff time is both an internal cost and a lost opportunity cost if other inventions are consequently not progressed, which is a particular consideration when competing priorities are present. The precise patenting costs will depend on the time employed by external patent agents in producing the patent plus filing (and if appropriate translation) costs.

The upfront costs for formation of a spin-out company similarly include those of patenting and the time of the inventor(s) and the technology transfer team in creating the business plan and negotiating the terms of the agreement for the spin-out company, plus the legal costs of incorporating the company. External upfront costs are generally charged to the spin-out company and will therefore be recovered in the

short to medium term. As for most if not all universities, Heriot-Watt University has a written procedure and regulation for the evaluation and creation of spin-out companies.

Essentially, the upfront cost should be minimised consistent with an effective exploration of the commercial opportunity. If the upfront cost is considered too high because of the absolute amount incurred, the high level of risk involved in commercialisation, or the relatively low estimate of the value of the opportunity, then commercialisation of the invention is generally not pursued unless this can be shared with a third party.

3.9 What do the inventors want to do?

The aspirations and intentions of the inventor(s) are of prime importance, particularly if a spin-out company is the preferred route to market. Therefore these should be established at an early stage. Generally inventor(s) should be fully involved in the commercial exploitation process to maximise the chance of success (up to the point, say, when the terms are negotiated for a licensing deal).

4. Protection

Intellectual property (IP) can be protected by patent, know-how/trade secret, copyright or design right. University intellectual property is typically protected by patenting the invention or keeping it secret as know-how, although computer software can also gain some protection from copyright. For a licensing deal, in order to enable a full disclosure of the invention to potential licensees, it is necessary to both protect the invention and hold discussions disclosing details of the invention under a confidentiality or non disclosure agreement (NDA). This needs to be customised for the actual discussion to be held and signed on behalf of the university by an authorised signatory. Even with the protection of the NDA the initial discussions should concentrate where possible on what can be delivered rather than how this is achieved. Naturally, full disclosure of the invention will be required to conclude the licensing deal.

4.1 Patenting

For a product that can be identified as arising from the invention, an appropriate protection route is to apply for a patent. Any patent infringement can potentially be identified by analysis of competitive products. Patenting prevents the manufacture and sale by a competitor in the countries covered by the patent(s) but is an expensive option and protection is limited to twenty years from the filing date. In order to be patentable an invention must be novel, inventive (and, for comprehensive patenting, not disclosed). A patent expert will be able to judge whether the invention is novel and inventive.

Patenting costs can be phased by initially filing a GB patent application to establish priority date and then proceeding via PCT (patent cooperation treaty) into the appropriate national phases. By investigating the commercial opportunity during each stage of patenting, a decision can be made whether to continue or not when the next set of patent costs becomes due. If during the initial twelve months of GB patent protection the commercial interest is low and no potential licensee has been identified

then the GB patent application can be withdrawn and commercialisation activity ceased. However, if commercial interest has been expressed and a potential licensee has been identified, then the patent can be extended into the PCT phase (retaining the GB priority date). In order to allow the licensee to input into the individual countries to file patent protection in, it is preferable to complete the licensing deal before the PCT period ends (i.e. within 30 months of the original GB filing date) if at all possible. It is critical to be able to co-ordinate patenting with commercial exploration of the opportunity in order to make an informed future decision on whether to maintain patent cover. Naturally judgement needs to be made at each stage of further patent costs since licensing deals may take time to identify and conclude (and may be unsuccessful). It is generally of very limited use to merely obtain a GB patent since the invention is then fully disclosed and only protected in the UK. In countries such as the USA and Germany where the home market is sufficiently large, a national patent is naturally more useful. It is risky to simply refile the GB patent application with a later priority date since any disclosures or competitive patenting in the interim period can cause serious problems. The university's patent portfolio should be periodically reviewed to ensure the cost of maintaining individual patents is warranted by the associated commercial opportunity.

In order to avoid the possibility of disclosure and consequent invalidation of a GB patent application, filing should precede circulating or posting (e.g. on a website) any details of the invention in the public domain. Given the requirement for university staff to publish papers and give presentations at conferences, the patenting process needs to run in parallel with these core activities. Provided the patent application is made prior to any public disclosure this should be sufficient. However, it is then critical to provide a full description of the invention in the patent application since any later improvements may be rendered unpatentable due to such disclosures. Sufficient notice is obviously required to write and file the patent. Ideally this requires a period of the order of six weeks in order to use external patent agents and allow for several meetings with the inventor(s). Shorter timescales can be accommodated but usually involve additional expense (due to having to claim urgent priority with external patent agents) and less time is available to fully and rigorously describe the invention. Once the patent application has been filed the invention can then be included in a publication or conference abstract and presentation.

4.2 Know-how/Trade Secret

Alternatively, a process invention may be protected by keeping it as know-how or a trade secret. This is particularly relevant if a spin-out company is the proposed route to commercialisation. Process inventions are suited to maintain as trade secrets since it can be difficult to identify infringement of process patents by competitors if the resultant product cannot be readily linked to the patented process. However, if a licensing deal is anticipated this will generally make the negotiations more difficult and may attract a lower resultant royalty income. For a spin-out company, a mixture of patent(s) and trade secret(s) to protect the intellectual property can be highly effective. Naturally, the risk of maintaining IP protection via trade secrets alone is that if the person with that knowledge leaves the company then the know-how can leak, which is of serious concern if that person joins a competitor or sets up in competition.

5. Exploitation

Typical commercialisation routes for university inventions, in increasing order of risk and potential reward, are consultancy, licensing, joint venture or spin-out company. Selection of the most appropriate commercialisation route can be based on a number of considerations. In general, exploitation via licensing is favoured by aspects such as a unique product that adds value to an existing system, patent protection in place, high upfront capital required, high volume needed, low cost manufacturing base required, fragmented market serviced by existing sales forces, supply deals in place, difficulty in accessing a route to market, well established competition, highly competitive cost conscious area, differentiation of innovation slight, the inventor(s) not wishing to input significantly into future exploitation and importantly that one or more potential licensees can be identified. Alternatively, exploitation by spin-out company formation is favoured by aspects such as a unique, sustainable, stand alone product, IP protection involving know-how as well as/instead of patent(s), lower upfront capital required, low volume/high value product, relative ease in accessing customers, an accessible route to market, a well differentiated product, inventor(s) passionate about exploiting the invention, an experienced team can be put in place and appropriate funding is available.

5.1 Consultancy

Transfer of technology in the form of information/expertise via consultancy is a low risk option for the university and directly assists industry while providing an income stream to the university and inventor(s).

5.2 Licensing

Licensing an invention to an existing company has the potential advantages of accessing an existing route to market with the appropriate expertise, providing an income stream for the university and inventor(s), and not requiring significant ongoing commitment from the inventor(s) (as may be the case in a spin-out company) so that they can continue with research and teaching commitments.

In licensing, ownership of the intellectual property remains with the university. Typically, an invention is ready for licensing discussions when experimental results are available, on say a laboratory prototype, and the IP has been protected by a patent application. Naturally, the precise approach adopted for licensing an invention may vary from case to case. Indeed, each licensing deal should be considered separately and the most appropriate terms for that particular case negotiated. In general, licensing involves protecting the invention, valuing the invention/IP, identifying suitable potential licensees, presenting the invention to potential licensees and negotiating a deal.

5.3 Payment/Deal Options

There is no standard deal in licensing and the final arrangement will follow detailed negotiation. Every deal needs to be treated separately and some of the possibilities are considered here. The payment provided by a licensee to a licensor for access to the invention can be based on a single upfront payment, an ongoing percentage royalty, or some combination of these. The licensor can grant an exclusive license or a non-

exclusive license limited by field of use, geographical region, etc. Where exclusive licenses are granted it is advisable to have safeguards in place in the agreement in case no sales revenue is generated, with the university nonetheless accruing patenting costs. These can take the form of a time limit on exclusivity (or the entire agreement) or some form of minimum running royalty regardless of sales revenue (the magnitude of which is agreed in advance).

An upfront payment has the advantage that even if the invention is never exploited the licensor receives payment, and therefore this approach reduces the risk to the licensor if commercialisation is likely to be several years in the future. Naturally, for these reasons an upfront payment may be undesirable for a licensee. The obvious disadvantage to the licensor of a single upfront payment is that this requires a reasonable estimate of the value of the invention, and this could be significantly undervalued. Conversely, the licensor may overvalue the invention (but such a deal is less likely to be agreed to by the licensee!).

For an ongoing, or running, royalty a charge is typically made on all sales of the product or service. This can be based on a percentage of sales revenue or profit. It must be specified in the agreement between the parties how the sales or profit figure is to be calculated. It is preferable to the licensor to base the royalty on sales since this is a straightforward figure to measure and record. The licensee may prefer to base the royalty on profit since this would allow them to recover certain costs before paying out a royalty. If development costs are to be recovered before royalty payments then the calculation of these needs to be carefully defined in the agreement, since such costs can be open to interpretation. The percentage royalty can be at a fixed rate or at one which either increases or decreases when specified future targets or milestones (e.g. sales figures) are met. Achieving certain milestones such as passing testing requirements would warrant increasing royalty as the invention is then potentially more valuable.

The advantage of a royalty payment is that a percentage of the true value of the invention is received by the licensor, which reduces the risk in trying to estimate the value of an invention. The disadvantage is that income may be delayed, particularly if further development is required, while the university is incurring patenting costs.

Therefore from the viewpoint of balancing risk and reward it is generally preferable for the university as licensor to receive some combination of upfront payment and ongoing royalty.

Alternatively, a company may wish to purchase the intellectual property rights, generally in the form of a patent(s), outright and request the university to assign them. This would be expected to be at a higher price than for a license since ownership is transferred. Assignation of the patent to the company does have the advantage to the company of it then being able to maintain and enforce patents precisely as it wishes to grow and protect the business. Provided appropriate reward is obtained by the university this approach does remove future risk and decision making and may therefore be appropriate for certain deals.

5.4 Valuing the Invention/IP

Valuing an invention is not an exact science, since it is truly worth what someone is willing to pay for it (an actual case of value pricing). The ideal case is to identify a company that needs that particular invention at that particular time and has the

resources to pay for it, undertake any further development required to make it ready for market, and commercialise it.

Therefore valuing an invention is an approximate process using inputs from a range of sources, and inevitably involves negotiation. In essence, the value attributable to the IP component of the potential business is isolated and agreed upon after considering the risks each party incurs. Although detailed computations such as net present value (NPV) calculations can be, and are, made a practical approach is also typically adopted. Certain "rules of thumb" are sometimes used too. The considerations and sources of information upon which to base an estimate of the value of an invention are explored below.

5.4.1 Cost of Development

Calculations based on money and/or time spent on an invention cannot be reliably used to value an invention and merely represent the sunk cost in getting to that stage.

5.4.2 Industry standards

Percentage royalties obtained in licensing deals in various industries have been collated and provide a useful guide to average figures achieved. Although there are significant ranges, the averaged data do suggest indicative royalty rates for these industries. In general, the manufacturing industries have an average royalty range of 3 – 7%, with internet/software/media industries having a higher average of 11 – 12%. These figures are quoted for a royalty percentage rate on sales. Some companies prefer to use a percentage of net profit. In this case the percentage figures will naturally be higher.

5.4.3 Stage of Development/Residual Risk

Typically, the more risk that has been eliminated from the opportunity, the greater the value created. Because in general the further developed an invention is the lower the risk of exploitation, an invention generally has greater value the further developed it is. Also a more developed invention requires less additional resources to ultimately exploit it. Naturally, the further an invention has been developed the greater the cost that has been incurred in reaching that stage, so a judgement needs to be made at what stage the invention is sufficiently developed to engage in licensing discussions. A company may consider paying the inventor(s) to further develop the invention as an initial stage in licensing the innovation. This has an immediate upfront payment benefit to the inventor(s) and university, and will naturally be taken into account in the terms of the subsequent license.

One view sometimes expressed by licensees is that the cost of further development should be taken into account and subtracted from sales revenue as a basis for the financial reward to the licensor. The cost of further development to the licensee may include technical development, marketing, regulatory, testing, and overcoming other barriers to entry. However, since advance estimation of the cost of further development is difficult, it is in the interests of the licensor to base royalties on a percentage of actual sales revenue.

Another area of risk for the licensee is the market risk, which includes the willingness of customers to purchase the new product or service and the competitive response to a new entrant. These factors will impact the estimated sales and profit. In addition, other risks may be present such as the need to license other IP, future technical

obsolescence, etc, which all increase the risk to the licensee and therefore decrease the value of the innovation to them.

5.4.4 Rights Granted in the IP

Typically, a non-exclusive royalty will attract a lower royalty rate than an exclusive one. Alternatively, exclusive rights can be granted in different fields of use/application areas or different geographical regions. A potential licensee may only require an exclusive license in their field of use, since the possibility of the invention being licensed to another company in a different field may be of no relevance since it would not be expected to affect their sales.

The ability to sub-license may attract a higher charge, but would presumably increase income for both licensee and licensor.

Usually the value of IP would increase as the geographical protection supplied to the innovation increases since the risk attached with exploiting the invention in a sustainable manner decreases. For example, a granted GB patent would be expected to attract a lower licensing income than a portfolio of European, North American, and Asian patents.

5.4.5 Benefit to Licensee

For a licensee to value an invention it needs to be of core and current interest, preferably of strategic significance. The value to the company may be in increased sales, increased profit, or cost savings. Ideally one would like to be able to value price the invention and arrive at a price that reflected the true value of the innovation to the licensee. A nice to have invention will not compete well for resources and is readily dropped when more urgent matters arise. Although it is reasonably straightforward to determine whether an invention is relative to a company and fits with existing business activities, it will be difficult in general to determine its importance. Absence of a response from a company may mean they are not interested or that the company contact used is not appropriate. Long delays in responding may reflect lack of interest or a time consuming, hierarchical, decision making company structure.

5.4.6 Value of comparable inventions

Benchmarking the value of comparable inventions may give an indication of the value of the particular invention being assessed. For instance, sales data on similar products in the target market, or indeed other markets, are a useful indicator. The price of similar or competitive products will give an indication of likely price and combined with sales volume will enable a total sales income to be estimated for such comparable or competitive products.

The target price that the invention can be launched at is a judgement, since although it will presumably have unique benefits, it will still need to displace a competitive product (either in-kind or not-in-kind) or introduce a new type of product. Apart from the useful early adopters, others will find the current situation quite acceptable unless they are experiencing real problems.

5.4.7 Value of the target market segment

It is usually possible to obtain sales figures for a particular market segment. Estimated projected sales based on market research can be used as a basis for estimating the

value of an invention/IP. By assuming that the invention in question will take a certain percentage of this market then an estimate can be placed on the sales value of the invention. A typical figure to use would be say 10%, provided the invention has one or more unique, sustainable benefits that would enable sales to be captured from competitors. Although it may be tempting to assume only 1% of a huge volume and argue that one therefore only has to capture a tiny proportion of total sales in that sector to generate significant revenue, this is invariably an excuse for an inadequate business case. Securing more than 20 or 30% of sales in an existing market would be a significant achievement and would require careful justification. There would inevitably be a competitive response to counter early gains.

So although crude, this approach does allow a figure to be calculated. A typical example to value an invention's IP in terms of a single upfront payment is as follows:

If projected future sales in target market segment per year = ***S***

Assume capture ***C%*** of these sales
For a time ***T*** (years) over which the invention could be expected to be sold (the estimated product lifetime)
For a typical royalty rate for that market sector of ***R*** % per annum
Then:

Crude Value of IP = **£ (*C*/100 x *S* x *T* x *R*/100)**

The prevailing economic conditions in the market sector will inevitably play a part in setting a royalty rate than can be agreed.

If the market segment targeted is difficult to quantify sales in, then use of sales figures from a comparable market segment would be a reasonable approximation, although generally less accurate.

5.4.8 Combination of Approaches

Naturally, estimation of the value of an invention by several means provides a more defensible position and should be sought where possible. The value of an invention in terms of an average percentage royalty can be taken from typical royalty rates for that industry or calculated as a one off payment from estimated sales as outlined previously. This can then be adjusted according to considerations such as stage of development and IP rights granted.

5.5 Identifying Potential Licensees

Potential licensees can be identified from a number of sources, however a personal introduction or reference is generally preferred if it can be obtained. Typical sources of contact names of companies and personnel within include inventor(s) and industry cluster groups, technology transfer group databases, consultants, market research, industry associations and trade fairs.

Typically, an inventor will have more industrial contacts than they realise, and this is a potentially rich source of contact names. Individuals that the inventor has dealt with in the past will not only be an appropriate entry into the company but will be able to act as an internal champion because they know the inventor (and his/her reputation in the field) and should have some understanding of the technology. It has been quoted that 40% of licensing deals are made with companies for which the inventor had the original contact. Other university staff may have relevant industrial contacts,

particularly those working in related fields to the inventor. The university's technology transfer group will have its own database of contacts, which needs to be kept up to date and supplemented by subsequent contacts, for instance at appropriate meetings and trade fairs. Industry cluster group champions (such as those of Scottish Enterprise) and their network of contacts may provide useful contact details. Searching the web using appropriate key words will also identify some companies working in that area who may be potential licensees.

If money is available, the use of an external consultant or market research agency can be used to identify potential licensees (both companies and contact names). For Proof of Concept projects in Scotland[2], obtaining market research using an external agency is an integral part of the project.

A non-confidential description of the invention can be posted on appropriate web sites which would be expected to be browsed by potential licensees. These include the university web site, innovation relay centre (e.g. via the Scottish centre[3]), and university-technology[4] (for Scottish universities). The university website needs to guide prospective licensees quickly and easily from the university or technology transfer home page to the description of the invention. Key word searches by potential licensees should identify links to the appropriate university web page. Potential licensees can be asked to register to be contacted regarding future new technologies in their area of interest.

5.6 Describing the Invention to Potential Licensees & Negotiating the Deal

A one page, non-confidential summary, or brief, of the invention is written by the technology transfer group with the inventor(s). These briefs generally share a common format and appearance to clearly identify the licensor (university) and facilitate communication of the offering. The brief should be written for a non-expert recipient and typically contains a descriptive title, background to the unmet need, summary of the invention highlighting the unique aspects (unique selling proposition), stage of development, inventor(s) name(s), benefits (not features), potential applications and technology transfer group contact details.

Once the patent application has been filed, the brief can be circulated to potential licensees without restriction. The brief is intended to bring the invention to the notice of a potential licensee and provide sufficient information so they can decide whether to pursue the opportunity or not.

If the company is interested, further communication is progressed under a standard non disclosure agreement with appropriately defined development and field, to maintain confidentiality. Use of the licensee's NDA instead of the university's can help to speed up the process (since the company's legal department does not have to scrutinise a new NDA, which can take some time) but care should be taken that this is suitable. The initial meeting should involve both the inventor(s) and technology transfer group, and aim to fully explain the invention so that the potential licensee understands what is being offered, its benefits, and the stage of development and if

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[2] http://www.scottish-enterprise.com/proofofconceptfund

[3] http://www.ircscotland.net

[4] http://www.university-technology.com

possible provide a practical demonstration of the invention. In addition, it should aim to answer the upfront questions that the potential licensee may have, establish whether the potential licensee is interested in progressing discussions, explore potential licensing models and agree a way forward and timescale for the next stage. Once agreement to pursue licensing in principle is reached, meetings are held between the potential licensee and technology transfer group plus legal representative to negotiate the details of the licensing agreement.

Once the terms of the agreement have been reached these are incorporated into a formal licence by the legal representatives of the two parties. Appropriate clauses should be included to retain access to the technology for further research by the university and to address the situation if the licensee does not commercialise within a given time period (most important for exclusive licenses). In a royalty on sales deal care should be taken that a significant patent bill is not built up with little or no royalty income received.

It is important to note that despite a unique invention and encouraging negotiations, it may not be possible to achieve a licensing deal with the company.

5.7 Joint Venture Company

A joint venture company may be the most appropriate commercialisation route if the preferred way forward is formation of a spin-out company but this new company would lack key skills or resources that a partner company would bring to the enterprise (e.g. established market, sales, or distribution route, complementary technology/products, spin-out management experience, etc).

5.8 Spin-out Company

Here a spin-out company is defined as a new company formed to exploit an invention developed within the university (using university owned IP), whereas a start-up company is a new company that exploits innovation from outside the university. In general the inventors would become the founders of the new company, possibly with others also involved. The university would generally also be a founding shareholder.

Commercial exploitation via a spin-out company has the advantages of the inventor being involved in commercialisation, which can be highly motivating, and formation of a local company that retains and attracts skilled individuals and provides potential future income and jobs. It also offers the potential to maximise the rewards of commercialising the invention to the founders. However, it is also the highest risk option, since the company, team, customer contacts, etc have to be created from scratch. A significant consideration for the university is the loss of at least a proportion of the inventor's time, up to complete loss if the inventor leaves to join the spin-out company full time. This can impact on ongoing research and teaching activities and will probably require the university to recruit new staff to undertake that workload. However, the inventor can become involved with a spin-out company in a number of ways, some of which have much less impact on his or her other duties (e.g. consultant or non-executive technical director).

Formation of a spin-out company generally involves protecting the invention, producing a robust business plan, negotiating the terms, obtaining permission from the university to spin-out the company via the appropriate review group(s), assembling

the management team, understanding the legal and financial framework and obtaining the required funding.

5.8.1 Business Plan

When one or more university inventors wish to form a spin-out company this will usually be discussed with the technology transfer team and a business plan drawn up. This should include a clear definition of the unmet need that the new product or service to be provided by the spin-out company can meet profitably. The business plan should describe the nature of the business proposition clearly, address the key issues, not concentrate too much on technology, analyse the market in sufficient depth, and show how the product will be developed, brought to market, and sustained. Sections should therefore be included summarising the product or service, intellectual property, market, manufacturing, financial projections, team, company structure, risk analysis and longer term plans. The plan should be written with the target reader in mind, who will not necessarily be a technical expert in that area (and generally is not). A reasonable length is a few pages, with appendices used to contain more detail. This is a working document, which should be regularly consulted and updated. A business plan will be required to not only focus the strategy and targets of the new company but also to present to potential investors. It should therefore include a description of how the investors will obtain a return on their investment. Help can be obtained in writing a business plan from various sources (including the technology transfer team) and numerous templates exist.

5.8.2 Agreement between University and Founder(s)

The terms of the agreement between the university and the spin-out company generally include any secondment details, use of university facilities, the university's equity share in the spin out company, the royalty rate for licensing intellectual property/patent(s) into the new company, access to future inventions (the anticipated pipeline) and appointment of a university director to the board. Usually the founding inventors will take an equity stake in the spin-out company. In addition, the university will generally take equity in the spin-out company. In general, university owned intellectual property will be licensed and utilised by the spin-out company for which a commercial royalty rate is charged. This combination of equity and licensing income provides both short term income and a potential longer term lump sum. Income from licensing the patent(s) provides short term revenue for the university with potential future income from ownership of equity in the spin-out company if this value is realised via a trade sale (to an existing company) or an IPO (initial public offering). Naturally, as future investors take equity in the spin-out company the university's percentage equity will decrease on dilution, but a small percentage of a significant opportunity should still provide useful income. However, since realisation of equity value held by the university may not be achieved or on dilution may be reduced significantly, payment of ongoing royalty is important to provide some likely income for the university from the venture.

Universities usually prefer to grant licenses (generally exclusive, world wide ones) to a spin-out company rather than assign the intellectual property to the new company. This is to safeguard the IP in case the new company fails and becomes insolvent, in which case any assigned IP would then belong to the receiver with the rest of the company's assets. By retaining ownership of the IP the university can potentially commercialise the technology via a different route if the company fails. However,

since business angels and venture capitalists in the UK tend to regard IP/patents as a soft asset of the new company[5], they strongly prefer it to be assigned to the spin-out company and will generally attempt to make this a condition of investment. In other countries such as the USA and Germany assignation of university IP to spin-out companies is generally not achieved by such funders. It can be argued by the university that a patent should not be regarded as a soft asset of a company since its presence prevents others from manufacturing and selling the product. Therefore an exclusive, world wide license with appropriate safeguards in the agreement on maintenance and defence against infringers should provide the same protection to the new company as ownership of the patent through assignation.

It is necessary to place a commercial value on the intellectual property/patent(s) in order to arrive at a licensing royalty rate. The approaches outlined previously for valuing intellectual property for licensing deals can be used.

Typically a new company will be more sustainable and valuable with an ongoing pipeline of new products. Therefore it is usually desirable to have preferential access on a commercial, royalty bearing, exclusive, world wide license basis to subsequent inventions in the group/laboratory that gave rise to the spin-out company technology. This should form part of the agreement between the new company and the university. However, this can be a difficult area since IP leakage is an issue, particularly in laboratories containing staff from both the university and the spin-out company. Maintaining laboratory notebooks to clearly identify date and ownership of future inventions is important in such situations.

Ongoing support for a spin-out company will generally include use of university facilities for a limited period of time (at commercial rates, agreed upfront). Access to, and cost of, university resources needs to be formalised in an agreement with the university. Beyond this, advice should be sought on the full range of facilities/resources required for a spin-out and these put in place to an appropriate timescale. Some items can take time to obtain so all future resources/facilities required should be clearly identified upfront with a plan for obtaining them.

Although spin-out companies often begin operation from university facilities, it is important for them to identify and obtain suitable, more permanent, premises. These premises for the new company naturally need to be suitable in all respects, with required resources included. Which facilities will be provided, the total cost of the premises, any restrictions on operation, and any time limitations should be clearly defined and included in an agreement, drawn up with the new company's legal agent. Organising a lease of premises can be very time-consuming.

5.8.3 Management Team/Board of Directors

Helping the founders to put together a robust management team is extremely important for the future success of the new company. The management team is typically one of the key aspects that potential funders such as venture capitalists will judge an opportunity on. It has been observed that an excellent management team can make a success of a fair business opportunity but that a poor management team can make an excellent opportunity fail. In general the spin-out company will have strong technical input but will typically require business management, marketing, and

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[5] P A Gompers and J Lerner, *The Money of Invention* (2001)

financial expertise. People with this expertise are typically found through the founders' network of contacts, enhanced by attending appropriate meetings, and will generally also be provided by funders such as business angels and venture capitalists as part of the funding deal. The university may also provide expertise in the form of a director and/or company secretary.

The new company will need a board of directors and company secretary. The board is responsible for the direction and strategy of the spin-out company, with executive management responsible for implementation. Directors owe a fiduciary duty to the company but must also have regard for shareholder's, employees', customers', etc interests and abide by legislation governing the rights of interested parties. A fiduciary is in a position of trust and is expected always to act in the interests of the other party to whom the duty is owed. It is fundamental that there should be no conflict of interest between the fiduciary's duties and his/her own personal interests, acting entirely impartially. Any declarations of interests should therefore be visible and clear. Information and training courses for directors can be obtained from the Institute of Directors[6].

Consideration should be given as to whether to employ the required additional expertise such as a chief executive officer (CEO), commercial director, etc on a part time or full time basis initially or use a specialist consultancy to provide this person during start up, since the remuneration required can be significant. Appointing an interim CEO is an option. The need for non-executive directors who bring particular expertise or experience to the new company and a scientific advisory board are additional considerations. In recruiting staff into the new company the managers should use a robust interviewing and selection process and may consider using an external agency to help with this.

5.8.4 Legal and Financial Framework

The founders also need to be aware of the legal, tax, VAT and insurance implications, and the technology transfer team can direct them to the appropriate departments/expertise. It is important for the new company to have its own legal representative at an early stage. The spin-out company should also obtain its own accountant at an appropriate stage to ensure proper bookkeeping and management accounts are kept and annual financial accounts prepared. It is important for members of staff holding equity in spin-out companies, whether or not they are active in the company, to obtain independent tax advice to understand the tax implications of business, particularly equity ownership. This can be obtained directly from the Inland Revenue[7]. Independent advice on VAT can be obtained directly from Customs & Excise[8]. Banks provide a range of advice, information, and services for small businesses, which should be explored at an early stage by inventors spinning out companies. A bank account will be required for the new company and consideration should be given to the authorised signatories on the account. Adequate insurance will be required to operate a new company and the company's independent legal adviser should be consulted on this. Relevant insurance considerations include building and contents insurance, employer's liability insurance, public liability insurance, and

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[6] http://www.iod.com

[7] http://www.inlandrevenue.gov.uk/bst/index.htm

[8] http://www.hmce.gov.uk/

product liability insurance. Additional legal requirements include compliance with employment law[9], health and safety requirements[10], and the companies acts[11].

5.8.5 Funding

Advice and support will also generally be given by the technology transfer group on sources of funding (e.g. SMART awards[12], business angels[13], and venture capitalists[14]), together with introductions if appropriate. Naturally, inventors should only approach the market for funding when they are investment ready. In addition, founders should consider whether the required funding can be supplied by themselves (or their families) or through debt. One source of income surprisingly often ignored is sales revenue. Sales not only provide income but also demonstrate to future investors the reality of the business case, and customers do not expect to receive equity in the new company.

Although the potential sources of funding can be readily summarised, it is critical to understand the needs of, for instance, venture capitalists and angels and to carefully select those to approach to maximise the chance of obtaining funding (e.g. one that invests in the technology area of the spin-out company). If possible it is generally advantageous to obtain an introduction. It is important to prepare and rehearse the presentation to potential investors. Attending external events where these funders give presentations and are available for discussions is a good way to learn about requirements and make personal contacts. It is also important to understand the terminology and aspects of such deals, which a legal adviser can give. In return for funding business angels and venture capitalists will require equity in the company and generally input management expertise. Business angels typically supply smaller amounts of investment than venture capitalists, and may therefore be suitable for some early stage funding. Consideration should also be given to the likely need for subsequent rounds of funding.

6. Conclusion

In addition to teaching and research, universities can successfully commercialise inventions by transferring them into the industrial environment. This requires different skills and experience so that a separate group within the university is usually charged with the responsibility for this activity. Access to legal and intellectual property/patenting expertise is critical, which may be available within the university team or externally. Naturally, the inventors play a critical role in technology transfer. Although each technology transfer deal should be treated independently, it is possible to separate this activity into four stages (identification, evaluation, protection, and exploitation) and give some general guidance and observations in these areas. As for all business deals, the final technology transfer deal obtained is that which is

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[9] http://www.dti.gov.uk/er/

[10] http://www.hse.gov.uk/startup/index.htm

[11] http://www.companieshouse.gov.uk

[12] http://www.scotland.gov.uk/about/ELLD/BGI/00016879/Innovationgrants.aspx

[13] http://www.nban.com

[14] http://www.bvca.co.uk

negotiated not that which is calculated, so that skill, care and due diligence are critical. The benefits to the university, industry, and the local and UK economy should encourage continued activity and growth in technology transfer.